

Lau, Stephan; Vogrin, Simon J.; D'Souza, Wendy; Haueisen, Jens; Cook, Mark J.:

Clustering of interictal events for improved source imaging and fMRI regressor design in high-density EEG-fMRI investigations

URN: urn:nbn:de:gbv:ilm1-2015210087

Published OpenAccess: January 2015

Original published in:

Clinical EEG and neuroscience : official journal of the EEG and Clinical Neuroscience Society (ECNS). - London : Sage (ISSN 2169-5202). - 44 (2013) 4, S. E34, FCI_4.

DOI: 10.1177/1550059413507209

URL: <http://dx.doi.org/10.1177/1550059413507209>

[Visited: 2014-10-14]

„Im Rahmen der hochschulweiten Open-Access-Strategie für die Zweitveröffentlichung identifiziert durch die Universitätsbibliothek Ilmenau.“

“Within the academic Open Access Strategy identified for deposition by Ilmenau University Library.”

„Dieser Beitrag ist mit Zustimmung des Rechteinhabers aufgrund einer (DFG-geförderten) Allianz- bzw. Nationallizenz frei zugänglich.“

„This publication is with permission of the rights owner freely accessible due to an Alliance licence and a national licence (funded by the DFG, German Research Foundation) respectively.“



Clinical EEG and Neuroscience

<http://eeg.sagepub.com/>

Abstracts of Presentations at the International Conference on Basic and Clinical Multimodal Imaging (BaCI), a Joint Conference of the International Society for Neuroimaging in Psychiatry (ISNIP), the International Society for Functional Source Imaging (ISFSI), the International Society for Bioelectromagnetism (ISBEM), the International Society for Brain Electromagnetic Topography (ISBET), and the EEG and Clinical Neuroscience Society (ECNS), in Geneva, Switzerland, September 5-8, 2013

Clin EEG Neurosci 2013 44: E1 originally published online 24 December 2013

DOI: 10.1177/1550059413507209

The online version of this article can be found at:

<http://eeg.sagepub.com/content/44/4/E1>

Published by:



<http://www.sagepublications.com>

On behalf of:



[EEG and Clinical Neuroscience Society](#)

Additional services and information for *Clinical EEG and Neuroscience* can be found at:

Email Alerts: <http://eeg.sagepub.com/cgi/alerts>

Subscriptions: <http://eeg.sagepub.com/subscriptions>

Reprints: <http://www.sagepub.com/journalsReprints.nav>

Permissions: <http://www.sagepub.com/journalsPermissions.nav>

>> [Version of Record](#) - Jan 21, 2014

[OnlineFirst Version of Record](#) - Dec 24, 2013

[What is This?](#)

FCI_4. Clustering of Interictal Events for Improved Source Imaging and fMRI Regressor Design in High-Density EEG–fMRI Investigations

S. Lau^{1,2,3,4}, S.J. Vogrin^{1,2}, W. D'Souza¹, J. Haueisen³, and M.J. Cook^{1,2}

¹Department of Medicine, St. Vincent's Hospital, University of Melbourne, Fitzroy, Queensland, Australia

²Centre for Clinical Neurosciences & Neurological R., St. Vincent's Hospital Melbourne, Fitzroy, Queensland, Australia

³Institute for Biomedical Engineering and Informatics, Technical University Ilmenau, Ilmenau, Germany

⁴NeuroEngineering Laboratory, Department of Electrical and Electronics Engineering, University of Melbourne, Parkville, Queensland, Australia

During presurgical planning in focal epilepsy, high-density EEG–fMRI of interictal activity can be used to locate epileptic foci in a multimodal context. The interevent variability in morphology and amplitude poses a problem for comprehensive identification of events and subsequent group analysis. Our objective is to develop a semiautomated method of identifying and clustering interictal events for improved electric source imaging (ESI) and fMRI regressor design.

A 128-channel EEG was recorded of a patient with left temporal lobe epilepsy in an electrically shielded room and during fMRI (1.5 T). The MR-gradient and cardiac pulse–related artifacts were removed. A representative interictal epileptic discharge (IED) from the shielded room recording was selected as the template and template matching using a set of indicative channels was performed to identify IEDs. The correlation and amplitude thresholds were relaxed to increase sensitivity. Intertrial correlations were calculated and used to cluster the

IEDs based on mean within-cluster correlation, which provided specificity. Clusters were averaged and a cortically constrained current density reconstruction (CDR, sLORETA) was performed using a boundary element model at the time period around the first peak and from that an equivalent dipole was derived. ESI-based cluster selections were used to define the regressor for the fMRI analysis (FSL FEAT, Gaussian smoothing FWHM 6 mm, double gamma HRF with +1 s, +3 s, +5 s, +7 s delays).

In the shielded room recording 456 events were detected over 35 minutes and in the scanner recording 233 in 25 minutes. Concordant event clusters could be identified as well as a separate group of spikes that occur within the sharp wave of a preceding spike. Weakly correlated events, for example, artifact corrupted or overlaid with other activity, could be separated and rejected. The left temporal blood oxygenation level–dependent (BOLD) activation was concordant with ESI. Selecting ESI-positive concordant event clusters for fMRI regression notably reduced spurious activation regions and isolated an otherwise unclear second contralateral precentral activation spatially concordant with the equivalent source of the postspike wave complex.

Semiautomatic event discovery and clustering can increase the sensitivity and specificity of IED analysis. ESI-based design of the fMRI regressor can notably improve BOLD contrast. Noninvasive ESI/fMRI of epileptic events shows promise in improving presurgical evaluation of epilepsy.